ORIGINAL ARTICLE

Differences in knowledge among patients with atrial fibrillation receiving non-vitamin K antagonist oral anticoagulants and vitamin K antagonists

Małgorzata Konieczyńska[1], Ewa Sobieraj[1, 2], Agata H. Bryk[1, 2], Maciej Dębski[1, 2], Maciej Polak[3], Piotr Podolec[1, 2], Barbara Małecka[1, 2], Andrzej Pająk[3], Lien Desteghe[4, 5], Hein Heidbuchel[4, 6], Anetta Undas[1, 2]

[1]John Paul II Hospital, Krakow, Poland

[2]Institute of Cardiology, Jagiellonian University Medical College, Krakow, Poland

[3]Department of Epidemiology and Population Studies, Institute of Public Health, Faculty of Health Sciences, Jagiellonian University Medical College, Krakow, Poland

[4]Faculty of Medicine and Life Sciences, Hasselt University, Hasselt, Belgium

[5]Heart Centre Hasselt, Jessa Hospital, Hasselt, Belgium

[6]University of Antwerp and Antwerp University Hospital, Antwerp, Belgium

Abstract

Background: Non-vitamin K antagonist oral anticoagulants (NOACs) are increasingly used for stroke prevention in patients with atrial fibrillation (AF) worldwide. Few articles have compared current understanding of AF patients about the disease and anticoagulant therapy in relation to the medications used.

Aim: We sought to compare the knowledge of AF and anticoagulation between AF patients treated with NOACs and those on vitamin K antagonists (VKAs).

Methods: We used the Jessa AF Knowledge Questionnaire (JAKQ), developed and validated in Belgium. Patients were recruited at a tertiary centre in Kraków, Poland.

Results: A total of 479 AF patients completed the JAKQ. Patients on NOACs (n = 276, 57.6%) compared with those on VKAs (n = 175, 36.5%) did not differ regarding demographic and clinical variables. The mean score of the JAKQ was very similar in the NOAC and VKA group (60.7 ± 17.0% vs. 61.6 ± 17.1%; p = 0.4, respectively). The differences in the proportion of correct responses referred to three questions. Consequences of AF, such as blood clots and cerebral infarction, were more obvious for patients on NOACs compared with those on VKAs (81.5% vs. 70.9%; p = 0.01). The patients on NOACs (78.7% vs. 67.6%; p = 0.009) more frequently considered consulting a physician for advice concerning anticoagulant treatment before surgery, while fewer patients on NOACs were aware of the need to take their medication even if they did not feel AF (76.1% vs. 89.7%; p = 0.0004). Only 25.9% of the VKA patients and 49.3% of the NOAC users knew what to do if they missed a dose of the anticoagulant.

Conclusions: The knowledge of arrhythmia and anticoagulation is better regarding the safety issues among subjects on NOACs compared with those on VKAs. Irrespective of the type of oral anticoagulation therapy, education of AF patients should be improved.

Key words: atrial fibrillation, non-vitamin K antagonist oral anticoagulants, vitamin K antagonists, questionnaire

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INTRODUCTION

The 2016 European Society of Cardiology (ESC) guidelines on the management of atrial fibrillation (AF) state that when oral anticoagulation (OAC) therapy is initiated in patients with AF (except for those with mechanical valve prosthesis or moderate-to-severe mitral stenosis), non-vitamin K antagonist oral anticoagulants (NOACs) are recommended in preference to vitamin K antagonists (VKAs) [1].

Address for correspondence:
Małgorzata Konieczyńska, MD, PhD, John Paul II Hospital, ul. Prądnicka 80, 31–202 Kraków, Poland, tel/fax: +48 12 614 25 56, e–mail: m.konieczynska@szpitaljp2.krakow.pl

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Convenience in use and lack of the need for cumbersome routine monitoring have increased the number of patients taking NOACs, despite the lack of reimbursement and prohibitive costs, especially for the elderly [2].

Regardless of the benefits, any anticoagulant therapy is associated with an increased risk of haemorrhagic complications. Therefore, it is important to educate both the patient and the caregiver. The vital role of education in the efficacy and safety of OACs is underlined by the consensus of the European Heart Rhythm Association (EHRA) and the practical guidelines [3, 4]. So far, most articles that evaluated the AF patient's understanding of the disease and therapy has focused on individuals taking VKAs [5–7].

Researchers from Hasselt University in Belgium developed and validated the Jessa AF Knowledge Questionnaire (JAKQ) to test the knowledge of patients with AF about this arrhythmia, its treatment, and the possibility of self-management [8]. The questionnaire seems to be an ideal tool to efficiently guide and target personalised education in AF patients, although its usefulness in other countries with different healthcare systems is unclear.

The aim of the current study was to evaluate knowledge gaps and current trends in OAC therapy in Polish patients with AF. Given the different reimbursement policies, OAC patterns with the predominance of acenocoumarol over warfarin among VKAs, and the lack of anticoagulation clinics in Poland, the present study was designed to confirm the usefulness of the JAKQ in another country. We sought to compare knowledge of NOAC vs. VKA users with AF and determine factors affecting correct responses for key safety issues.

METHODS

Patients

We recruited patients with documented AF, who were referred to the John Paul II Hospital in Kraków (Poland), from November 2016 to May 2017. Eligible patients were > 18 years of age and were able to provide consent. We excluded unconscious patients or those in Intensive Care Units.

In the presence of the managing physicians, 513 patients with AF were asked to complete the questionnaire.

Questionnaire

We used the JAKQ from Hasselt University in Belgium after having obtained formal consent and performed its translation into Polish. The Questionnaire has been validated and described in detail previously [8]. This questionnaire contained 16 questions. The study was in full compliance with the Declaration of Helsinki [8], and approval from the local Ethical Committee was obtained.

Questionnaires were anonymous, and oral consent was obtained from each patient. The JAKQ consisted of multiple choice questions (four answers) with only one correct answer. In each question there was an "I do not know" option to avoid guessing. A correct answer was scored as 1 point and an incorrect or "I do not know" answer was scored as 0 points. Questionnaires were collected by doctors who completed general information about patients and medical data in a chart (Table 1). Completed charts were passed to an administrative official in our Hospital who collected and inputted data into a computer but was unaware of the aims of the survey. Data verification was performed subsequently by another person. The number of properly completed charts was 479 (93.4%). Twenty-five (4.9%) charts were excluded due to multiple answers, and nine (1.8%) were excluded because of insufficient clinical data. A total score was calculated from completed questions and displayed as the percentage.

Clinical data

We collected relevant clinical data using an original questionnaire for clinicians participating in this study. We also documented the type of anticoagulation therapy with the drug dose, the presence of antiplatelet therapy (acetylsalicylic acid and/or clopidogrel), or history of VKA treatment in the past. We asked about the presence and type of diabetes, heart failure, and vascular disease. Valve replacement denoted the presence of an implanted cardiac mechanical valve prosthesis. Mitral stenosis was defined according to the ESC guidelines and classified from mild to severe. Major bleeding events were defined according to Schulman et al. [9].

Statistical analysis

Continuous variables were presented as means (standard deviation) or median (interquartile range) as appropriate. The Kolmogorov-Smirnov test was used to determine the normal distribution of variables. Categorical variables were reported as numbers and percentages. The χ^2 test was used to compare categorical variables. The ANOVA or Kruskal-Wallis tests for continuous variables were used to assess differences between the groups. Multivariate logistic regression analysis was conducted to determine which variables were significant predictors of correct responses to selected questions. Backward logistic regression was applied. Statistical analyses were performed using SPSS 23.0 (SPSS Inc., Chicago, IL, USA). P-values < 0.05 were accepted as statistically significant.

RESULTS

Characteristics of the sample studied

A total of 479 patients with AF were included in the final analysis (Table 1).

There were 175 (36.5%) patients treated with VKAs (82 [17.1%] on warfarin and 93 [19.4%] on acenocoumarol) and 276 (57.6%) patients treated with NOACs. As few as 10 (2.1%) patients received low-molecular-weight heparin at therapeutic or intermediate doses as stroke prophylaxis, while two (0.4%) subjects were taking acetylsalicylic acid 75 mg/day in monotherapy. Sixteen (3.3%) patients did not receive any antithrombotic treatment on the day of completing the questionnaire.

Table 1. Characteristics of the study population

	All (n = 479)	Patients treated with VKAs (n = 175)	Patients treated with NOACs (n = 276)	p
Age [years]	69.2 ± 10.8	69.6 ± 11.0	68.0 ± 10.5	0.4
Male sex	273 (57.0%)	104 (59.4%)	150 (54.3%)	0.3
Type of AF:				< 0.001
Paroxysmal	204 (42.6%)	57 (32.6%)	130 (47.1%)	
Persistent	75 (15.6%)	8 (4.6%)	66 (23.9%)	
Permanent	200 (41.8%)	110 (62.9%)	80 (29.0%)	
Time interval since AF diagnosis [months]	48 (14–100)	90 (48–144)	26 (10–60)	< 0.001
Time interval since initiating the OAC [months]	24 (8–55)	72 (36–120)	12 (5–24)	< 0.001
Comorbidities:				
Heart failure	201 (42.0%)	93 (53.1%)	99 (35.9%)	0.0004
Arterial hypertension	409 (85.4%)	147 (84.0%)	241 (87.3%)	0.3
Diabetes mellitus	168 (35.1%)	69 (39.4%)	94 (34.1%)	0.3
Valve replacement	40 (8.4%)	39 (22.3%)	1 (0.4%)	< 0.001
Mitral stenosis	11 (2.3%)	7 (4.0%)	3 (1.1%)	0.04
Prior myocardial infarction	104 (21.7%)	40 (22.9%)	57 (20.7%)	0.59
Prior stroke or TIA	82 (17.1%)	24 (13.7%)	55 (19.9%)	0.09
Vascular disease	151 (31.5%)	65 (37.1%)	82 (29.7%)	0.1
History of major bleeding	50 (10.4%)	11 (6.3%)	30 (10.9%)	0.1
Easy bruising	198 (41.3%)	87 (59.7%)	104 (37.7%)	0.01
Gingival bleeding	79 (16.5%)	31 (17.7%)	45 (16.3%)	0.7

Data are given as mean ± standard deviation, median (interquartile range), or number (percentages). AF — atrial fibrillation; NOACs — non-vitamin K antagonist oral anticoagulants; OAC — oral anticoagulation; TIA — transient ischaemic attack; VKAs — vitamin K antagonists

Heart failure, mostly New York Heart Association (NYHA) class II or III, and history of myocardial infarction were observed more commonly among men compared with women (49.1% vs. 32.5%; $p < 0.001$ and 27.8% vs. 13. 6%; $p < 0.001$, respectively). Easy bruising on the current anticoagulant therapy was more frequently reported by women (57.7% vs. 28.9%; $p < 0.001$) with no difference for gingival bleeding between the two sexes.

General results

The median percentage of correct responses was 62.5 (50–75; minimum 6.2% and maximum 93.7%).

An inverse correlation between age and the percentage of correct responses was observed ($r = –0.18$, $p = 0.01$). Women scored better than men, although they were older (66.7% [50–75] vs. 60% [50–68.8]; $p = 0.01$). Also, patients with mitral stenosis (68.8% [62.5–75] vs. 62.5% [50–75]; $p = 0.05$) and gingival bleeding (68.8% [53.3–75] vs. 62.5% [50–75]; $p = 0.040$) achieved better results.

Individuals with a history of myocardial infarction (62.5% [50–75] vs. 60% [46.7–68.8]; $p = 0.01$) and vascular disease scored lower on the JAKQ (56.3% [50–68.6] vs. 66.7% [51.7–75]; $p < 0.001$).

Most of the patients responded correctly to the question about the definition of AF (76.2%), possible thrombotic consequences of the arrhythmia (77.7%), and the purpose of anticoagulant therapy (80.6%). There was also good knowledge about the time interval for international normalised ratio (INR) control (93.6%) and the definition of INR (90%).

As shown in Table 2, about one-third of AF patients knew that AF is not always symptomatic (34.4%) or that they should not consult a physician every time they feel it (30.3%). Furthermore, only 35.5% of patients perceived AF as a progressive condition. Of note, half of the patients did not know how to detect AF or which painkillers are the safest in combination with anticoagulants (Table 2). However, women were better informed about the safest painkillers and the progressive nature of AF (58.3% vs. 41.7%; $p = 0.0005$ and 43.4% vs. 30.2%; $p = 0.004$, respectively).

Knowledge of AF patients on VKAs vs. NOACs

The AF patients on NOACs versus those on VKAs were similar regarding demographics. Larger proportions of patients with paroxysmal and persistent AF treated for a shorter period with anticoagulants were observed in the NOAC group (Table 1). Heart failure (35.9% vs. 53.1%; $p = 0.0004$) and mitral

Table 2. Specific topics addressed in the Jessa AF Knowledge Questionnaire (JAKQ) with the percentage of correct responses among AF patients treated with VKAs and NOACs

	All (n = 479)	VKA patients (n = 175)	NOAC patients (n = 276)	p
Eight questions about AF in general				
AF is a condition where the heart beats irregularly and often faster than normal	365 (76.2%)	134 (76.6%)	209 (75.7%)	0.8
AF is not always accompanied by symptoms	165 (34.4%)	53 (30.3%)	99 (35.9%)	0.3
Patients can detect AF by taking their pulse regularly	240 (50.1%)	81 (46.3%)	145 (52.5%)	0.18
AF can cause blood clots that can lead to stroke (cerebral infarction)	372 (77.7%)	124 (70.9%)	225 (81.5%)	0.01
Medication cannot prevent AF permanently because the arrhythmia will increasingly occur with ageing, even when taking medication	170 (35.5%)	66 (37.7%)	96 (34.8%)	0.5
An AF patient should not go to the general practitioner or emergency room each time he/she feels AF	145 (30.3%)	60 (34.3%)	74 (26.8%)	0.1
Being overweight exacerbates AF	259 (54.9%)	91 (52.9%)	154 (56.6%)	0.44
Blood thinners are often prescribed for patients with AF in order to prevent the development of blood clots in the heart, which can lead to stroke	386 (80.6%)	136 (77.7%)	227 (82.2%)	0.2
Five questions about OAC therapy				
Patients with AF should always take their blood thinners, even if they do not feel AF	387 (80.8%)	157 (89.7%)	210 (76.1%)	0.0004
Possible side effects of blood thinners are the occurrence of bleedings and longer bleeding times in case of injuries	353 (73.7%)	127 (72.6%)	206 (74.6%)	0.7
AF patients may only take painkillers based on paracetamol	227 (47.4%)	88 (50.3%)	128 (46.4%)	0.5
When AF patients regularly have minor nose bleeds (that spontaneously cease), they should contact the general practitioner or specialist, while continuing to take their blood thinner	336 (71.5%)	127 (73.8%)	191 (71.2%)	0.4
If an AF patient needs an operation, he/she should consult a doctor to discuss possible options	348 (73.9%)	117 (67.6%)	214 (78.7%)	0.009
Three questions about VKA				
AF patients taking VKA should have their blood thinning checked at least once a month	236 (93.6%)	163 (93.7%)	73 (93.6%)*	0.99
When AF patients taking VKA have forgotten to take their blood thinner, they should still take their forgotten pill (immediately or at the next dose)	65 (25.9%)	41 (23.7%)	24 (30.8%)*	0.3
INR is a measure to check how thick or how thin the blood is	225 (90.0%)	153 (88.4%)	72 (93.5%)*	0.2
Three questions about NOAC				
For patients taking NOAC, it is important to take their blood thinner at the same time every day			250 (92.3%)	
When AF patients taking NOAC have forgotten to take their blood thinner, they can still take that dose, unless the time till the next dose is less than the time since the missed dose			134 (49.3%)	
The NOAC card should be shown to their general practitioner and specialist by AF patients			53 (26.4%)	

*VKA used in the past; INR — international normalised ratio, other abbreviations — see Table 1

stenosis (1.1% vs. 4.0%, p = 0.04) were observed less commonly among NOAC users. All patients with mitral stenosis treated with NOACs had a mild degree of valve disease.

The risk of bleeding was similar in both groups; nonetheless, intense bruising was less frequently reported on NOAC treatment compared with VKA (37.7% vs. 59.7%; p = 0.01).

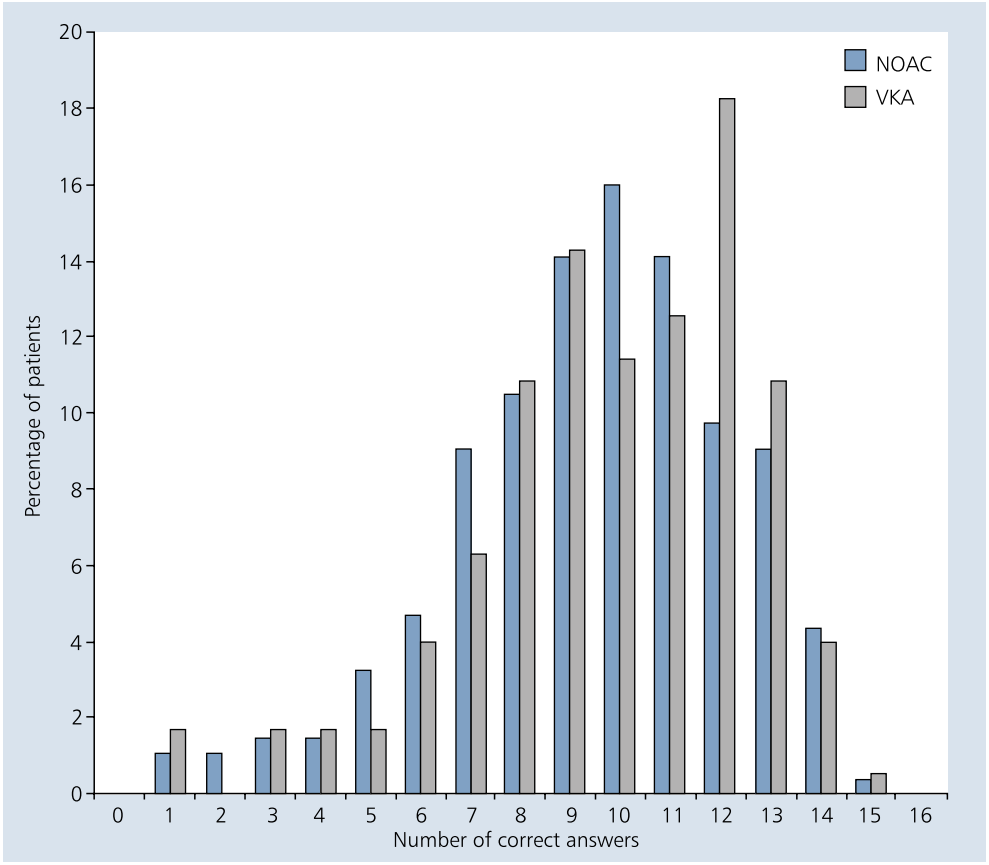

Figure 1. Distribution of correct responses in patients treated with non-vitamin K antagonist oral anticoagulants (NOACs) and vitamin K antagonists (VKAs)

There was no difference in the distribution of correct answers between NOAC and VKA patients (Fig. 1). The mean score on the JAKQ was 60.7% ± 17.0% in the NOAC group and 61.6% ± 17.1% in the VKA group ($p = 0.4$). We observed significant differences solely in responses to three questions. Consequences of the arrhythmia, such as blood clots and cerebral infarction, were more obvious for patients on NOACs (81.5% vs. 70.9%; $p = 0.01$). This group would also more frequently consider consulting a physician before an operation to discuss possible options concerning their OAC medication (78.7% vs. 67.6%; $p = 0.009$) (Table 2). However, NOAC users were less conscious about the importance of a regular anticoagulant intake despite the lack of symptoms (76.1% vs. 89.7%; $p = 0.0004$). Of note, as few as 26.4% of NOAC patients reported receiving a safety information card when starting OAC treatment and were familiar with its purpose.

Knowledge of AF patients on three different NOACs

In the NOAC group, 142 (51.4%) patients were taking rivaroxaban, 114 (41.3%) subjects were on dabigatran, and 20 (7.2%) patients were on apixaban. Eighty-seven (31.5%) individuals receiving NOACs were previously treated with VKA. Reduced NOAC doses were recorded in 47 (33.0%) patients receiving rivaroxaban (15 mg daily), in 43 (37.7%) patients on dabigatran (110 mg twice daily), and in 12 (60.0%) individuals on apixaban (2.5 mg twice daily).

Comparison of AF patients on three NOACs showed similar demographic and clinical characteristics except for the duration of anticoagulation therapy (the shortest for apixaban, $p < 0.001$), previous major bleeding ($p < 0.01$), and current gingival bleeding ($p = 0.03$). Of note, the two latter features were more frequently observed in the apixaban group, indicating that this agent was preferentially used in high-bleeding-risk subjects (**Suppl. Table 1 — see journal website**).

Knowledge of AF patients on three different NOACs was similar (**Suppl. Table 2 — see journal website**). Any differences were observed only in the OAC treatment section. All patients taking apixaban were aware of possible bleedings during anticoagulation, but only 60% knew that they should take OAC regularly even in the absence of AF symptoms ($p < 0.001$).

Table 3. Predictors of correct responses to three key questions related to the safety of anticoagulation

	AF patients may only take painkillers based on paracetamol			When AF patients taking NOAC have forgotten to take their blood thinner, they can still take that dose, unless the time till the next dose is less than the time since the missed dose			When AF patients taking VKA have forgotten to take their blood thinner, they should still take their forgotten pill (immediately or at the next dose)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Age							0.97	0.94–0.99	0.012
Sex:									
Male	1	1.20–2.60	0.004						
Female	1.77								
Hospital:									
Hospital	1			1					
Outpatients	2.24	1.51–3.23	< 0.001	3.27	1.95–5.49	< 0.001			
Diabetes mellitus:									
No							1		
Yes							2.23	1.23–4.03	0.008
Gingival bleeding:									
No				1					
Yes	2.06	1.21–3.49	0.008	2.00	0.97–4.11	0.06			
Valve replacement:									
No									
Yes	2.79	1.34–5.79	0.006						
Vascular disease:									
Yes				1					
No				1.66	0.95–2.92	0.078			

CI — confidence interval; OR — odds ratio; other abbreviations — see Table 1

Predictors of correct answers to selected questions

We chose three questions regarding the safety issues and analysed factors that determined correct responses to them.

Only 47.4% of the AF patients were aware that the safest painkiller in combination with OAC therapy is paracetamol. Demographic factors that related to more correct responses in the whole group were: female sex (odds ratio [OR] 1.77; 95% confidence interval [CI] 1.20–2.60; p = 0.004), outpatient status (OR 2.24; 95% CI 1.51–3.23; p < 0.001), gingival bleeding (OR 2.06; 95% CI 1.21–3.49; p = 0.008), and valve replacement (OR 2.79; 95% CI 1.34–5.79; p = 0.006).

As few as 23.7% of the VKA patients knew what to do when they missed an OAC dose. Factors associated with correct response among VKA patients were age (OR 0.97; 95% CI 0.94–0.99; p = 0.012) and diabetes mellitus (OR 2.23; 95% CI 1.23–4.03; p = 0.008).

A similar question regarding the missed OAC dose was answered correctly by 49.3% of the NOAC users. Outpatients had significantly more correct responses (OR 3.27; 95% CI 1.95–5.49; p < 0.001), whereas the presence of gingival bleeding (OR 2.00; 95% CI 0.97–4.11; p = 0.06) and the lack of vascular disease (OR 1.66; 95% CI 0.95–2.92; p = 0.078) showed borderline statistical significance (Table 3).

DISCUSSION

The present study compared the knowledge about arrhythmia and its treatment among NOAC vs. VKA users with AF and demonstrated the usefulness of the JAKQ in Polish patients. We expanded observations published by Desteghe et al. [8], by showing that despite the fact that NOACs were only introduced a couple of years ago in daily practice, the knowledge of patients receiving this group of medications was similar to that of subjects on VKAs. Nevertheless, the use of NOACs was associated with more correct responses for most key safety questions in the JAKQ. Remarkably, most of our patients receiving NOACs knew that it is important to take their blood thinner at the same time every day. The patients on NOACs would more frequently consider getting medical ad-

vice about anticoagulant treatment before surgery. Knowledge of AF patients on rivaroxaban, dabigatran, and apixaban was similar. This held true also for VKA-naïve patients on NOACs and those previously receiving VKAs. We also identified predictors of correct responses for these relevant questions, highlighting the need for additional educational interventions.

Similarly to the study by Desteghe et al. [8], Polish patients had a satisfactory level of knowledge about the definition of AF, its consequences, and the necessity of anticoagulation therapy. However, there was no question answered correctly by all patients and there were still different knowledge gaps in these patients. The proportions of correct responses in other studies that evaluated the knowledge of AF patients were lower [6, 10]. This suggests that with time, in 2017, the knowledge about AF and stroke prevention has improved. In a multi-ethnic study published in 2002, 37% of subjects were not aware of their AF diagnosis and 47% did not recognise that having AF put them at an increased risk of stroke [11]. In our study the consequences of the arrhythmia, such as blood clots and cerebral infarction, were more obvious for patients on NOACs, presumably because the attending physicians emphasise the benefits of using new, more expensive drugs. VKA users were treated significantly longer; also, the vital role of education, and the indication to discuss with patients the choice of OAC, including the safety issues, were emphasised as late as in the ESC guidelines from 2016 [1].

Although our results highlight some major knowledge gaps among VKA users, we found that most of our patients on VKA were aware of the mandatory monthly INR monitoring. Our results were better compared with the study by Desteghe et al. [8] and the EHRA study, with lower proportions of correct responses (81% and 76%, respectively) [12].

Regarding the gender issue, we observed that women with AF scored better than men, although they were older. This finding disagrees with Desteghe et al. [8], who failed to observe any gender-related differences. It might be speculated that this difference is associated with a better health status in women because heart failure and prior myocardial infarction were less frequent among them in the current study. Interestingly, women were also better informed about the safest painkillers during OAC use. It has been reported that there is more frequent use of painkillers in women, hence their greater awareness of this problem might be associated with higher scores observed by us.

The novelty of our study was to identify the factors associated with correct responses to selected questions about safety issues of OAC therapy. Patients who correctly indicated painkillers were more often outpatients, women, and had a history of valve replacement or gingival bleeding. This may be related to greater caution when using various drugs by those who have had concomitant diseases and minor bleeding. Those with prosthetic heart valves were found to be better informed about OAC. In our hospital those patients receive an OAC guide with a discharge card and they also have regular outpatient visits, which probably has a great impact on their knowledge in this field.

Regarding the current trends in anticoagulant therapy in AF patients, we showed that a large proportion of subjects is receiving NOACs (predominantly rivaroxaban), even though patients with AF are not reimbursed for these medications in Poland. Interestingly, among patients treated with NOACs, only one-third previously received VKAs. Desteghe et al. [8] also demonstrated that 64.4% of the entire AF population used NOACs. In the study conducted by EHRA in 2015 among patients from eight European countries, NOAC use ranged from 31.9% in Swedish patients to 8.2% in Norway. There were regional differences regarding the preference of a certain NOAC [13]. The use of rivaroxaban and dabigatran among our NOAC users with AF (51.4% vs. 41.3%, respectively) was similar to the results of the multicentre NOAC-TURK study published in 2017, in which 39.6% of patients were on rivaroxaban and 38.1% were treated with dabigatran [14].

Of note, in the present study, reduced NOAC doses were recorded in a substantial proportion of patients, and it appears to be larger than that reported in previous studies [15–17]. As expected, our patients receiving reduced doses of NOACs were older and had a history of previous bleeding. Therefore, our data reflect a common everyday practice to prescribe reduced doses of NOACs in high-bleeding-risk patients with AF. However, it is advisable to stick to the current ESC guidelines and prescribe lower NOAC doses according to the current recommendation, i.e. mainly in individuals with renal impairment [1]. Exploration of the reasons for such lower doses of NOACs in our cohort was beyond the scope of the current study.

The popularity of NOACs among Polish AF patients is probably related to the advantages of their use as compared to VKAs. NOACs are easier to administer because they can be given in fixed doses without the need for laboratory monitoring [18]. Since in Poland the quality of anticoagulation treatment is rather low due to the lack of anticoagulation clinics [2], physicians encourage patients to use NOACs, despite their high cost, in order to increase the efficacy and possibly safety of long-term anticoagulation. Our study compellingly demonstrates that NOACs are an attractive therapeutic option preferred by patients even if there is no favourable reimbursement policy and the cost of their use is substantial, as in Poland.

The study has several limitations. It was conducted at a hospital dealing with cardiovascular disease with well-organised clinics for outpatients with thrombotic diseases and OAC complications; therefore, our results could not be easily translated to primary care or other hospitals.

We did not analyse the effect of the patients' level of education on AF-related knowledge. A larger multinational study is needed to identify key knowledge gaps among AF patients to improve everyday care.

In conclusion, we observed that the knowledge about AF and OAC is similar between subjects on VKAs and NOACs. However, there is better knowledge regarding the safety issues in the latter group. Irrespective of the type of OAC therapy, education of AF patients should be improved, with particular emphasis on the safety issues of this treatment.

Conflict of interest: *Małgorzata Konieczyńska has taken part in conferences sponsored by Bayer and Boehringer Ingelheim; Piot Podolec, Anetta Undas have received lecture honoraria from Bayer, Boehringer Ingelheim, Bristol Myers Squibb, Pfizer, Sanofi-Aventis; Hein Heidbuchel has been a member of the scientific advisory boards and lecturer for Boehringer Ingelheim, Bayer, Bristol Myers Squibb, Pfizer, Daiichi-Sankyo; Andrzej Pająk received personal fees from AMGEN and Sanofi, not related to submitted work.*

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